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Behaviour, Emotions and Wearable Technology

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Final thesis for a BA-degree in Fashion Design

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Abstract

The way we dress has many different meanings and purposes. In the past years clothing has taken a step into the world of technology, a concept that has been termed *wearable technology*. This thesis aims to examine the connection between dress, technology and wearer. Even though wearable technology is today mostly concentrated on the health monitoring, the focus in this thesis will be on wearables in innovative fashion design and what that means for the wearer. The thesis will depart in an introduction to wearable technology, with a brief historical description and what focus wearable technology has had up to today. Further a number of fashion theories on how we determine the material reasons of why we dress will be presented and three concepts: protection, modesty and camouflage will be discussed as possible explanations. The thesis will then study the concept of meaning with the aim to determine how we have meaningful relationships, both with people around us but also with our clothing. The chapter will look at how behaviour can be altered, for example by colours, and by the end of the chapter emotional expression will be examined as a crucial part of the human behaviour. In the last chapter three projects carried out by designers will be presented followed by a discussion about how they investigate the relationship between the human, clothing and wearable technology. How these designers are studying the human emotions and behaviour and merging this with wearables will also be analysed. The analysis holds a theory supported argument about the difficulty to generalize the material reasons for clothing. Therefore clothing might be more about the emotional meaning of the clothing and how it works as communication between the wearer and viewer, and that it is possible for wearable technology to change that communication and meaning.

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Introduction

The Liljevalchs Museum in Djurgården, Stockholm opened an exhibition in September 2015 called Utopian Bodies – Fashion Looks Forward. The exhibition focused on the future of fashion design and exhibited designers and innovators that had in anyway focused on or changed the way we see fashion design going. One section in this exhibition was dedicated to technology and designers like Ying Gao was exhibiting two of her dresses, one activated by gaze and one by voice. What intrigued me was that clothing became something that happened between two people. The dresses would change into different shapes and forms when someone looked at them or talked to them, just like humans have different emotional reactions when being looked at or talked to. The aim for this thesis is to examine when clothing stops being only clothing and becomes something more. In early school years, I took many classes in psychology since behaviour has always been a big interest, how we act in social situations and what happens in our mind in relationship to others. This is something that fashion has always been to me, a way of saying something about yourself in a public space without talking. Clothing and fashion is behaviour in itself and it feels only natural that we would use it as communication.

When I was younger and looking at other children and teenagers there were some cues in clothing that you could interpret into behaviour. It was easy to interpret gender by colours, prints and choice of garments, it was often easy to tell what class the children came from and even mood could be visible in the choice of clothing. Even if gender and class are defined by parents and not a personal choice by the children it was still a way of knowing who people are. When looking back at that time and those interpretations it is easy to see it as judgemental but I believe that studying clothing is more than that. I believe that it is a way we communicate who we are to the society we are living in, even if it is to signal that you are not a part of that society. By researching why we actually dress, I have had to go into old fashion theory and choose parts that I have felt relevant in this context, even if the material is excessive. One question that has occurred in this process is 'Why do we feel the need to hide/expose through clothing?' And 'if what we wear is to show who we are, how do we know that the message goes through?'

The world is changing and the fashion industry is possibly an industry that is changing more and more rapid than most other industries. The concept of fashion, however, has not changed that much in centuries. Textile is still covering the body and clothing still signals

social code and status. Clothes are still sewn with needles and threads and sold in stores. Clothing design has quite a small frame to work from and it is foremost because it needs to be able to be worn. And that is where wearable technology comes in, as a concept that is taking fashion further, involving the wearer in the wearing of clothes. Wearable technology can read heartbeat and body temperature to tell us how many calories we are burning but also tell if we are aroused or excited. By reading the most basic bodily functions and using it for training and fitness why not use these calculations as evaluation for emotions? If we would show our feelings more openly, 'wear your heart on your sleeve' as the saying goes, could it change the way we looked at clothing? And could it change the way we look at relationships? The designers that will appear in this text are exploring how projecting emotions on the outside of clothing can create new social interactions. This thesis will explore if it can and if so, then how?

This text will depart in a brief historical description into what wearable technology has been up to until now and where the focus has been in wearables in the recent years. It will then overview a number of fashion theories, to find out why we wear clothing at all – if it is for protection, modesty or communicating. I am interested to see how big part the human behaviour plays in clothing and if we change by clothing or if the clothing is changed by us. Further the thesis will explore certain theories on how we determine the concept of meaning. This will be done to be able to understand how our mind works when we have meaningful relationships, both to people around us, but also to clothing and how that meaning is interpreted by the people around us.

Later in the text I look at how behaviour can be altered by colours. Colours seem like such simple things but it can alter both how we perceive others but also how we perceive ourselves. Emotional expression is a part of behaviour which we cannot control but is a crucial part of how we communicate. I am interested to see how we are communicating through emotional expression and what consequences it has in our social life. In the last chapter the thesis will focus on projects carried out by designers and how they investigate the relationship between the human, clothing and wearable technology. How these designers are studying the human emotional and behavioural life and merging that with wearable technology will also be analysed.

1. Wearable Technology

Wearable technology, *wearable devices* or simply *wearables*, are the terms used for electronics or computers that are integrated with clothing and accessories and worn somewhere on the body. Examples of this are watches, headphones and glasses. However, in the last 20 years wearables have evolved and are now also gadgets that can monitor health with sensors for closer observation or long term monitoring by physicians. Another platform for wearables are training and fitness – in form of, for example, fitness trackers that track steps, distance, skin temperature and perspiration. These trackers are connected to a mobile device to monitor progress and estimate calorie burn. Smart clothing or smart textiles are another part of the fitness oriented wearables. Sensors and fibres are merged with textiles or clothing and function in a similar way as the fitness trackers, to monitor training in a completely nonobtrusive manner.[1]

Even though wearable technology might be seen as something new it can be dated back to the time when pocket watches and wristwatches became a trend in Europe in the 19th century. Before all this, the history of wearables can be dated back to the 17th century where the Abacus ring is seen as the pioneer for wearable technology. This portable piece of jewellery was not connected to any kind of power-source but you were able to perform mathematical calculations through moving small beads on wires. It was not until the 20th century that wearable technology took a big step in the development of the relationship to its wearer with Virtual Reality (VR). VR is a computer system that projects a virtual or imaginary environment for the user with for example a headset. With VR applications, the wearer could feel like a part of a certain environment or situation and thereby experience deeper emotions. This technology system could enable a movie to become a multisensory experience, where wind would blow in your face, smell simulators would activate your smell senses and the chair would be moving. In the 1920's, Edward Link created what today is considered the first commercial flight simulator. It was created to safely train pilots for combat, with mechanic devices that would imitate disturbances and turbulence for the sense of reality.[2]

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[1] Robin Wright and Latrina Keith, "Wearable Technology: If the Tech Fits, Wear It." *Journal of Electronic Resources in Medical Libraries* 11, no. 4 (October 2, 2014): p. 204–208.
[2] Jane McCann and David Bryson, *Smart Clothes and Wearable Technology*. Cambridge: Woodhead Publishing, 2009: p. 10-15.

Today wearables are mostly focused on gadgets for training, well-being and monitoring health. Many companies are using this small nonobtrusive technology to monitor patients that need monitoring over extensive periods of time. An example is monitoring ECG (Electrocardiography), which have been a part of health evaluation for over thirty years but that has not been suitable for long term observing. The wearable systems overcome the limitations of site constrictions and makes it possible for physicians to observe the patients that need to be monitored in outside conditions or home environment for long periods of time.[3]

Wearable technology has also been picked up by fashion designers to explore new ways to create garments. This text will focus on those innovations, referred to as *fashionable wearables* or *fashionable technology*. The term fashionable technology was coined by Sabine Seymour in 2000 and refers to the merging of functional technology and aesthetics, fashion and style. Seymour claims that garments and dress are a direct interface to the society and environment and therefore works as "a constant transmitter and receiver of emotions, experiences and meaning".[4]

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[3] Paolo Bonato, "Wearable Sensors/Systems and Their Impact on Biomedical Engineering." *IEEE Engineering in Medicine and Biology Magazine: The Quarterly Magazine of the Engineering in Medicine & Biology Society* 22, no. 3 (June, 2003): p. 18–20.

[4] Sabine Seymour, *Fashionable Technology: The Intersection of Design, Fashion, Science, and Technology.* New York: Springer, 2012: p.12.

2. Theory of Clothing and Dress

Many words have been written about fashion theory and most of them are exploring the relationship between clothing, the wearer and cultural identity. Fashion theory explores the term fashion "as the cultural construction of the embodied identity"[5] and this chapter will explore how some of these theories can explain how we use clothing and for what reasons. This chapter will concentrate on the material and concrete reasons for clothing. Even if we wear clothes for different reasons and with different meanings, Lurie means that for whatever purpose we do it, we do it to communicate and that we wear clothes for the same reasons as we speak. She argues that clothing is much like any other language, like French or German, built up by words to create sentences and states that;

> [...]as with human speech, there is not a single language of dress, but many: some (like Dutch and German) closely related and others (like Basque) almost unique. And within every language of clothes there are many different dialects and accents, some almost unintelligible to members of the mainstream culture. Moreover, as with speech, each individual has his own stock of words and employs personal variations of tone and meaning.[6]

Lurie means that before verbal communication takes place a non-verbal conversation has already happened. Through our clothing we communicate age, gender and class. Lurie states that we also announce occupation, personality, sexual orientation, opinions and tastes, even if sometimes unconsciously and sometimes misinformed.[7]

2.1 Protection

Protection can be seen as one of the prime reasons for clothing, protecting us from weather conditions like cold, wind and heat and from other situations like physical dangers and accidents. Even though it might not actually protect us from real dangers it is the meaning we pair with the word; 'protection'. It is the feeling of protection that we value more than the actual protection itself. To say that clothing is a basic human need shows problematic since the idea about basic human need differs between cultures. Flügel uses Darwin's

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[5] Valerie Steele, "Letter from the Editor." *Fashion Theory* 1, no.1 (April, 2015): p. 1–2.
[6] Alison Lurie, *The Language of Clothes*. New York: Random House, 1981: p. 205.

[7] Alison Lurie, *The Language of Clothes*. New York: Random House, 1981: p. 205-209.

explorations in Tierra del Fuego as an example of how different a twentieth century European can be from the indigenous people Yaghans in terms of basic need of protection.

> Darwin's often-quoted observation of the snow melting on the skins of these hardy savages seems to have brought home to a somewhat startled nineteenth-century generation that their own snug garments, however cosy and desirable the might appear, were not inexorably required by the necessities of the human constitution.[8]

There are also many religions and traditions where garments and adornments are believed to protect from evil and moral dangers. Early archaeologic expeditions find that primitive tribes wore little protective clothing but wore amulets and adornments for spiritual purposes, which leads us to believe that to protect the being might have been more important than to protect the body.[9]

2.2 Modesty and Immodesty

Another theory why we are wearing clothes is for modesty, that the option of not wearing clothes is unthinkable or not really an option at all. We dress to hide certain body parts that would be seen as shameful to show in public. This theory shares the same problems as the theory of wearing clothes for protection, since it varies greatly between cultures it cannot be used as a general idea. There is "no essential connection between clothing and modesty, since every society has its own conception of modest dress and behaviour".[10] Therefore we cannot say that we generally define clothing as concealment or as a system to cover body parts that are shameful. There is not one general rule for what is shameful and not and Flügel (1969) argues that it was with the fall of the Graeco-Roman civilization that modesty increased. Christianity plays a big role in how people looked at the body. The bible emphasises the soul over the body and that the best way to achieve a clean soul was to conceal the body. The body was seen to be connected to desire and was therefore to be hidden to prevent sin and shame.[11]

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[8] John Carl Flügel, *The Psychology of Clothes*. New York: International Universities Press, 1969: p. 17.

[9] Alison Lurie, *The Language of Clothes*. New York: Random House, 1981: p. 206.

[10] Mary Ellen Roach and Joanne Bubolz Eicher. *Dress, Adornment, and the Social Order*. New York: Wiley, 1965: p.10.

[11] John Carl Flügel, *The Psychology of Clothes*. New York: International Universities Press, 1969: p. 58.

Young children do not have a sense of modesty or shame connected to the body, this is something that is taught in a social context and teaches them which body parts are shameful and should be covered up. Since modesty is a learnt behaviour from the society and culture we are in, concealment is therefore a cultural behaviour and not a general rule.[12]

The opposite of wearing clothing for concealment and modesty would then be immodesty, the idea that clothing would serve as a motivation for exhibitionism. Laver tries to explain the purpose of clothing in his theory of the *Utility, Hierarchy and Seduction principles*, where the *Utility Principle* is dressing for warmth and comfort, the *Hierarchy Principle* is dressing to indicate one's position in society and the *Seduction Principle* is dressing to attract the opposite sex. Laver argues that men dress for the two first reasons and that women dress only for the Seduction Principle and thereby select clothing that makes them more attractive to men. His theory is that throughout history the man has selected a partner on the basis of attractiveness and women select a partner on the basis of how well they can provide for and take care of a family.[13]

This theory has been widely criticized (for example Rouse, 1991) for different reasons. One criticisms is the same as the one applied to the theory of modesty and concealment – that the theory cannot be used as a general rule because it is different between cultures. Though it is possible that there is dress that is worn to display and enhance a social or sexual attractiveness of both women and men there are many cultures where such display has a different meaning or no meaning at all. Laver states that this is a natural behaviour of men and women as behaviour is natural to animals. Rouse criticize this by saying that "clothing cannot be reduced to a mere trigger for a biological mating instinct".[14]

In addition to this critique the study is quite outdated in the sense that it is focused on a simplified view on heterosexual attraction and with no understanding of other forms of relationship structures than the heterosexual one.

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[12] Malcolm Barnard, *Fashion as Communication*. New York: Routledge, 2013: p. 53-56.

[13] James Laver, *Modesty in Dress: An Inquiry into the Fundamentals of Fashion*. London: Heinemann, 1969: p.14.

[14] Elizabeth Rouse, *Understanding Fashion*. New Work: Wiley, 1991: p. 15.

2.3 Camouflage

One can argue that another form of modesty is camouflage, to use clothing as a way to blend in to an environment, much like a chameleon uses its skin. Potvin stated that "to be correctly uniformed is to fit perfectly into a set social group" and therefore calling it 'social camouflage'.[15] Social camouflage is the process of using clothing and fashion to blend in at any given social landscape. Basically wearing the right things at the right time.[16] Holman suggests that it is more than just the military that uses camouflage and that any effort to not stand out and fit in is used in the same way. We cover up blemishes with makeup, we cover bad smell with perfume and deodorants and wear clothing that take attention of certain body parts or make them less visible or to emphasize others. Holman means that this is a true form of camouflage and that that the wearer does it to not draw attention to themselves and often doing so in the public space. Clothing is in this instance used as a way not to draw attention to the wearer.[17]

In all cultures we can see clothing and dressing being used as protection, camouflage, modesty and exhibitionism. Even though it varies, sometimes beyond recognition between cultures, it is all to communicate a position and standpoint within the society and to those outside of it.

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[15] John Potvin, *The Places and Spaces of Fashion, 1800-2007*. New York: Routledge, 2008: p. 95.
[16] John Potvin, *The Places and Spaces of Fashion, 1800-2007*. New York: Routledge, 2008: p. 90.

[17] Rebecca H. Holman, "Apparel as Communication", in *SV - Symbolic Consumer Behaviour*, eds. Elizabeth C. Hirschman and Morris B. Holbrook. New York: Association for Consumer Research, 1981: p. 7-15.

3. Behaviour and Meaning of Dress

Dressing is one of the fundamentals in the human social behaviour and to understand why, I will look at both the material reasons why we dress (Chapter 2) and the behavioural and social reasons. Therefore this chapter will explain a few behavioural and social theories that can be applied on fashion and clothing.

In 1931 the American sociologist Herbert Blumer developed a theory he called *Symbolic Interactionism*, a theory that can easily be connected to clothing and what it means for us today. Blumer uses the term to approach how human interaction works. Blumer states that symbolic interactionism rest on three premises; the first premises is that humans act on things on the basis of what the meaning that thing has to them. Things that you encounter on a daily basis, like a chair, painting, a mother, bus driver, friend or enemy. It also includes what meaning places have for us, like school, institutions or government. It also refers to more abstract things as the meaning of freedom, honesty or requests. In this text the example would be what meaning the things we wear have for us. The second premises is that these meanings arise from the interaction with the people around us. This indicates that the meanings of things are learnt when being shared with others. In this case the interaction that happens between the wearer and the viewer. The third premises is how the meanings of things are modified by how the individual deals with the things he/she encounters. This indicates that the individual is in an active process in deciding the meaning of things in the interaction with others. In the case of clothing, this would mean that the wearer processes the meaning of dress through himself/herself in interaction with other individuals or situations.[18]

Another theory that has similarities to Blumers' symbolic interactionism was Stone's so-called *Program and Review*. Much like Blumer, Stone believes that the self acquires identity when situated in a social situation and that dress helps communicate identity in that social situation. Stone labelled an individual's communication of the self and its identities through dress their 'Program' and when situated in a group, the appraisal the individual's program receive Stone labelled as 'Review'.[19] After experience in social interaction individuals start to learn how others are likely to react to their dress. If these

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[18] Herbert Blumer, *Symbolic Interactionism: Perspective and Method*. Los Angeles: University of California Press, 1986: p. 2-6.

[19] Gregory P. Stone, "Appearance and the Self." in *Human Behavior and the Social Processes: An Interactionist Approach*, ed. A.M. Rose. New York: Houghton Mifflin, 1962: p. 92-93.

predictions of reactions are right the perceiver's image of the individual will be coherent with the image that the individual is admitting to show. Stone calls this 'validation of the self'[20] and leads to satisfactory social interaction. However, if the individual's program is not picked up by the reviewer, the individual's signals of identity is not understood or coherent with the reviewer, social interaction will become difficult.[21]

3.1 Behaviour and Colours

We are more affected by colours than we realise and in many cases the associations we have with colours are highly unconscious. Where the associations come from is hard to generalise but a lot of research has been carried out on the connection of colour and meaning.

Among chimpanzees, the females display the colour red on their bodies, to signal to the males when the mating season is starting. The colour red is highly connected to sexuality, passion and lust that has likely emerged from biological tendencies of our primate relatives. In research carried out by D. Niesta Kayser, J. Elliot and R. Feltman (2010) studies show how wearing different colours changes how we interact with each other. In one experiment twenty-three heterosexual men were randomly assigned one of two images of a woman, either in a green t-shirt or in a red t-shirt. They were then asked to choose questions they would ask this woman, the questions varied in degree of intimacy. The study showed that heterosexual men were more likely to ask more intimate questions to the woman wearing the red t-shirt than when wearing the green t-shirt. In another experiment participants (heterosexual men) were randomly assigned one of two photos, one of a woman wearing a red t-shirt and the same woman wearing a blue t-shirt. They were then invited into a room and shown a chair where this woman would soon sit and were then asked to take a second chair for themselves and place anywhere in the room to have a conversation with this woman. In this study, the distance between the chairs were significantly shorter for the men who had been shown the photo of the woman wearing red.[22]

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[20] Gregory P. Stone, "Appearance and the Self." in *Human Behavior and the Social Processes: An Interactionist Approach*, ed. A.M. Rose. New York: Houghton Mifflin, 1962: p. 102.

[21] Mary Ellen Roach-Higgins, Joanne Bubolz Eicher, and Kim K. P. Johnson. *Dress and Identity*. New York: Fairchild Publications, 1995: p.13.

[22] Daniela Niesta Kayser, Andrew J. Elliot and Roger Feltman, "Red and Romantic Behaviour in Men Viewing Women." *European Journal of Social Psychology* 40, no. 6 (October, 2010): p. 901–908.

In popular culture we can see how colours are used to strengthen or acknowledge certain character traits. For example; in old movies it is often easy to separate the bad guys from the good: the bad guys wear black hats. In children's movies today the evil personas are often dressed in black or is situated in a dark place. Reports show that most cultures associate the colour black with evil, sorrow and death.[23]

The colour black has also been proven to change how we act. In research carried out by Frank and Gilovich, studies show that football and hockey players that wear black act more aggressive than players wearing any other colour. By analysing penalty records of football and hockey teams the research showed that uniform colour is highly related to penalty frequency. Black uniformed teams are ranked the highest in amounts of penalties and in situations where a team changes uniform colour in the middle of a season reports show drastic changes in aggression in players.[24] To exclude the possibility that the referee's decision was bias due to colour, another experiment was set up by a staged football game to see if the referee was more likely to penalize a team if they were wearing black uniforms. Even though it was the same teams just changing shirts, the referee penalized the black uniformed team more often than the team wearing white.[25] This shows that colour of dress both affects how individuals perceive the self but also how being perceived by others. In many situations, black is chosen as dress possibly because of the awareness of what the colour symbolizes, like for example Hell's Angels who dresses in black to symbolize power or danger. In other situations, because of the choice of colour we become 'the bad guy', both in the eyes of others but also in how we perceive ourselves in the way the colour is perceived.

White is along with black and red the colours that have the most similar cultural meanings within different countries. White has the cultural meaning of purity, goodness and also peace and surrender.[26] In research from 2000, studies show that white, blue and green get clustered together in similar meaning associations. All eight countries in the study indicated that these three colours all have peaceful, gentle and calming qualities. In this study there were no significant differences in meaning across countries of the colours

[23] Francis M. Adams and Charles E. Osgood, "A Cross-Cultural Study of the Affective Meanings of Colour", *Journal of Cross-Cultural Psychology,* Vol 4, no. 2, (1973): p. 147-151.

[24] Mark G Frank and Thomas Gilovich, "The Dark Side of Self- and Social Perception: Black Uniforms and Aggression in Professional Sports", *Journal of Personality and Social Psychology 54*, no.1, (1988): p.76-79.

[25] Mark G Frank and Thomas Gilovich, "The Dark Side of Self- and Social Perception: Black Uniforms and Aggression in Professional Sports", *Journal of Personality and Social Psychology 54*, no.1, (1988): p.79-81.

[26] Tektronix, *The Color Connection.* Morton, IL: Catharine & Sons, 1998: p. 1-45.

black, red, green and white but yellow, orange, purple and brown tend to have different meaning for each country.[27]

3.2 Emotions as Social Function

Emotional expression is a part of behaviour that we cannot control but is a crucial part of how we communicate with others. It serves as signal in social interactions and adds meaning to and enhances social bonds. Haidt and Keltner (1999) introduces four functions of emotions; "(1) individual (intrapersonal); (2) dyadic (between two individuals); (3) group (a set of individuals that directly interact and has some temporal continuity); and (4) cultural (within a large group that shares beliefs, norms, and cultural models)."[28]

At the individual level the emotions work as a reaction to a social interaction. The individual's conscious feeling of emotions react to what is happening around us and that typically needs to be acted upon. Like love signals the feeling of commitment to another person or shame signals his or her lower status to another person. This occurs even without the knowledge of other individual's interpretation but only within our own emotional life. At this level, the emotions also prepare us for social interaction, for problems and opportunities that we are faced with.[29]

The second level is the dyadic function of emotions, it's when emotions play of another person's emotions. It is the system that reacts in accordance with how behaviour is interpreted by another individual. For example, children rely on their parents' emotional responses to know if they are safe or in danger before they learn spoken language. We also sometimes alter our own emotions in accordance to other individual's emotion response, for example in fear of snakes. In relations to others, our emotions evoke emotional responses in others, like anger evokes fear and distress evokes sympathy.

The third level is the analysis of the group which focuses on the interaction between a collection of individuals who shares a similar belief or situation. In this case emotions help

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[27] Thomas J Madden, Kelly Hewett and Martin S. Roth, "Managing Images in Different Cultures: A Cross-National Study of Color Meanings and Preferences", *Journal of International Marketing: Winter 2000*, Vol. 8, No. 4, (2000): p. 96-98.

[28] Dacher Keltner and Jonathan Haidt, "Social Functions of Emotions at Four Levels of Analysis", *Cognition and Emotion 13*, no. 5 (September, 1999): p. 506.

[29] Dacher Keltner and Jonathan Haidt, "Social Functions of Emotions at Four Levels of Analysis", *Cognition and Emotion 13*, no. 5 (September, 1999): p. 509–510.

determining group identity and boundaries. A part of realizing group boundaries could be a dislike towards individuals outside the group and this can strengthen the emotions of belonging. Within the group, emotional behaviour can help to determine individual's statuses and roles. Emotional behaviour and reactions can also help to solve group-related problems and strengthen social bonds.[30]

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[30] Dacher Keltner and Jonathan Haidt, "Social Functions of Emotions at Four Levels of Analysis", *Cognition and Emotion 13*, no. 5 (September, 1999): 510–513.

4. Fashionable Wearables

Textile and technology might feel like they don't go together since the notion that technology is known to be "hard" and textile and clothing known to be "soft". The fact is that a lot of designers today are working on merging the two components to create new experiences and a new way to look at fashion. Sabine Seymour is researching how we can challenge our conception of what clothing is and what it can become in the future through technology. In her research, Seymour claims that the functions of clothing can be enhanced by technology and new functions can be defined.[31] With the theories from chapter 2 and 3 in mind, three design projects were chosen to see how technology and clothing can be merged to enhance the emotions and behaviour of the wearer.

4.1 Blushing

One project carried out by Philips Design in 2006 is one of many design projects that are using the wearer of the clothes to be more visible through the clothing. The *Skin Probe Project* created the *Bubelle* – the Blush Dress to make emotions more lucid than we often choose to show. The Bubelle is made up by two layers; a tight inner layer with sensors that read and respond to the wearer's emotions, doing this through heartrate, body temperature and nervous system and an outer layer made up by textile panels and LED lights. The light reflects and reveal the wearer's emotions by altering the lights and showing various patterns. The blushing dress behaves differently depending on whoever is wearing it, and illustrates completely nonlinear behaviour because of the wearers' nonlinear emotions.

Blushing is a phenomenon that happens in the human body when we are experiencing emotional excitement. Embarrassment, arousal, shame and anger are a few emotions that trigger blushing and are an involuntary response to situations.[32] Darwin called it "the most human of all expressions"[33] but yet we are trying very hard to hide it in public situations. It is not only involuntary but the effort of trying to not blush often increases the blushing

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[31] Sabine Seymour, *Fashionable Technology: The Intersection of Design, Fashion, Science, and Technology*. New York: Springer, 2012: p.13.

[32] Ray Crozier and Peter de Jong, *The Psychological Significance of the Blush*. New York: Cambridge University Press, 2012: p. 2-4.

[33] Charles Darwin, *The Expression of the Emotions in Man and Animals*. London: John Murray, 1872: p. 310.

because of self-awareness.[34] The Bubelle dress is therefore contradicting how we usually react in a social setting and alters how we approach social interactions.

4.2 Arousal and Excitement

Another project from The Skin Probe Project by Philips Design is the *Frisson* body suit. Much like the Bubelle dress it has sensors that reads and responds to skin signals via biometric sensing technology, reading our nervous system and illuminating LED lights in various patterns. Unlike the Bubelle dress it measuring the level of excitement and glows up when the wearer is feeling arousal.

Both Bubelle and Frisson takes physical responses and show them in a spectacular form. The project was a way of "communicating with those around us by using garments as proxies to convey deep feelings that are difficult to express in words."[35] The Dutch design studio Studio Roosegaarde, founded 2007, started a project in 2010 called *Intimacy*. A series of dresses made from electronic foil, a type of plastic-like material that changes from transparent to cloudy, were created in versions *Intimacy Black* and *Intimacy White* and *Intimacy 2.0*. The e-foil is connected to a power source and is activated by the wearer's heartbeat and body temperature, ultimately the dress becomes transparent when the wearer is aroused or excited.[36] In a talk for the Design Indaba Festival, designer and the founder of the studio, Daan Roosegaarde explains it as a "second skin of information" and that he wanted to create a new way of communication. Roosegaarde says that "…suddenly we are not looking at a bloody Iphone screen anymore but instead it's a part of us, it is sort of like we are in co-control"[37], when talking about the project. In a way our emotions are controlling the garment but since we often cannot control our emotions we cannot control the garment. Roosegaarde explains that the reason for the project was to investigate what

[34] Charles Darwin, *The Expression of the Emotions in Man and Animals*. London: John Murray, 1872: p. 310-311.

[35] Susan Elizabeth Ryan, *Garments of Paradise: Wearable Discourse in the Digital Age*. Cambridge: MIT Press, 2014: p. 121

[36] "Intimacy", Studio Roosegaarde, Accessed November 25, 2017, https://studioroosegaarde.net/project/intimacy.

[37] Studio Indaba, *"Daan Roosegaarde: When Innovation and Imagination Merge"*, video, 30:44, posted August 30, 2013, Accessed November 25, 2017. http://www.designindaba.com/videos/interviews/daan-roosegaarde-when-innovation-and-imagination-merge.

we want out of technology and what technology wants from us.[38] The designer creates a design that acts like an extension of our collective skin, something unfinished and that changes with the wearer. Designs that engages people in a social, emotional, semi-functional way to enhance the awareness of the world that is shaping around us.[39]

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[38] Studio Indaba, *"Daan Roosegaarde: When Innovation and Imagination Merge"*, video, 30:44, posted August 30, 2013, Accessed November 25, 2017. http://www.designindaba.com/videos/interviews/daan-roosegaarde-when-innovation-and-imagination-merge.

[39] Studio Roosegaarde, *"Interview Daan Roosegaarde about his new book 'Interactive Landscapes'"*, video, 05:27, posted November 1, 2010, Accessed November 25, 2017. https://vimeo.com/16386303

5. Analysis

By looking into fashion theories I realized that identifying why we dress is difficult to generalize since most meaning of dress alters between cultures. If we think we dress for protection or for modesty, another culture will have different meaning onto those concepts. The material theories studied in chapter 2 gave an understanding that we dress for different reasons and those reasons differ between cultures, sometimes beyond recognition and therefore cannot be used as a general rule. This somewhat answers my question why we feel the need to hide/expose through clothing; it is no general rule that decides why we hide or expose through clothing, but countless of reasons for every single culture.

By looking at different theories on behaviour and emotions I found an understanding how we can define meaning, for example the theory of Symbolic Interactionism by Blumer. His three premises are a good example of how we interpret meaning. It is also a theory that applies to all cultures since it is in what way we apply meaning for ourselves, others around us and how meaning changes in that interaction.

By using this theory along with Haidt and Keltner's theory of the functions of emotions and apply it to fashion design it is easier to understand how we dress and why. By using the second level of this theory and apply it to wearable technology I aim to answer the question if wearables can alter how we look at relationships. The second function of emotions describes the dyadic level, how the individuals' emotions plays against another individuals emotions. In this case the individual would be the wearer and would possibly be exhibiting the emotions on the outside of his/hers clothing, like in the Bubelle dress, the Frisson body suit or the Intimacy dress. Since the wearers' emotions would become more lucid to another individual and therefore be given a clearer idea of the wearer. This could possible create a more honest and meaningful relationship or possibly eliminate unwanted attention.

The Bubelle, the Frisson and Intimacy are all examples of fashionable technology that are managed automatic. The garments respond to the wearers' unconscious bodily reactions and not to the wearers' choices. This is possibly where these design projects differs from our every-day way of dress. The choice of what we choose to show. The Intimacy dress works as a hint to reveal attraction, something that might be difficult to say in words for many people. The question is if we want or need to have the choice to not reveal attraction. If these design projects would be managed manually they would possibly lose their

purpose and only become an extension of our conscious choices. Much like normal clothing. Although, to manually manage the wearables could possibly have its advantages since the wearer could control others interpretations of himself/herself. By again looking at the theory of emotions (Haidt and Keltner) along with the research carried out in chapter 3.1 (Niesta Kayser, Elliot and Feltman 2010 and Frank and Gilovich 1988) and applying it to wearable technology, there could be clothing where you would manually change the colour of the garments to alter the viewers emotions. By changing the colour to blue or green to minimize unwanted attention, changing the colour to black to appear more powerful or dangerous or changing it to red for possible romantic attraction.

Conclusion

The aim of this thesis was to look closer into how we define the meaning of clothing and how wearable technology could change or alter that meaning. I believe that wearable technology will integrate more in clothing design and make us rethink our relationship with our clothes. Another point I wanted to investigate was if wearable technology in clothing could change our relationship to ourselves and to others.

With the examples of fashionable technology I mention in this thesis, this has brought me to a belief that wearable technology can make that action, why we dress, become more transparent and more visible. I believe that we dress to communicate who we are and what we want other people to see us as, sometimes both and sometimes only one of the matters. By showing emotions more clearly, on the outside of clothing for example, I believe that it can change our relationships with people around us. Showing emotions creates a different behaviour in both the wearer and in the observer and I believe this will make us have more meaningful relationships, since we become less afraid to show emotions.

Today wearable technology is mostly focusing on the medical, health and fitness spectrum and is being evolved and produced commercially in rapid speed and only a few designers are working on wearables as a product based on emotions. Relations to the self and ones' own being is in focus and not the relations to others around us. Is it possible that we are putting body over mind?

I believe that we are possibly not yet ready to show our emotions transparently and might not ever be. Animals use their body to show emotions, like a dogs wagging tail or showing of teeth but humans have body language and have created spoken language to communicate and possibly exhibiting your emotions in an exaggerated way is not something that we need. This type of wearable technology is possibly not made for everyday use and therefore could not be commercialize but maybe the idea alone can open the discussion if 'wearing your heart on your sleeve' has its advantages.

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